REMARKS:

The application now comprises claims 1-18 with claims 1, 10, 17 and 18 being independent.

The first paragraph on page three has been amended to delete a typographical error, namely "and" in line 11.

The drawings were objected to as failing to comply with 37 CFR 1.84(p)(5) in that reference character 60 set forth at page 18, line 21 of the specification is not shown in Fig 7b. Applicant hereby submits corrected copies of Figures 7a and 7b, both corrected to include reference numeral 60. A copy of said figures showing the correction in red is also included. Reference numeral 60 is placed on Figures 7a and 7b in same location as on Fig 5a.

The specification was objected to in that the controller/decoder set forth on page 15, lines 30-31 and page 16, line 15 was identified only by reference numeral 62 and should instead reference both 62 and 64. Submitted herewith is an amendment of the two paragraphs running from page 15, line 18 to page 16, line 18 with "controller/decoder 62" replaced by --controller 62 and decoder 64-- in agreement with said components as set forth in the drawings.

Claim 6 was objected to in that "increasing" as in "buffer size is increasing" should be - -decreasing --. The examining is correct and that change has been made to claim 6. Claim 1 has been amended to indicate that the jitter buffer is enlarged or shrunk to hold more or fewer packets. Spelling or purely editorial corrections have been made in claims 2, 4, 6 and 10.

Claim 17 has been rewritten as an independent claim incorporating all of the claims upon which it was previously dependent. Claim 18 has been added directed to claim 1 to including features of method claim 17 found to render said claim allowable.

Claims 1-8 and 10-16 were rejected under 35 USC §103(a) as being obvious based on Ohlsson (US Patent 6,452,950) in light of Cohen (US Patent 6,389,032) in that, in regard to independent claims 1 and 10:

a) Ohlsson discloses a receiving node and a method in a packet communication system that minimizes delays in packet delivery for digital voice communication by using the internet as the backbone for transmission of data comprising a jitter buffer having a variable

storage size arranged to receive packets, store the packets and serially output the packets and a jitter buffer manager which monitors arrival of said packets, determines at least one variation parameter which measures the variation in transit delay among arriving packets and controls jitter buffer size in response to the variation parameter; and

b) Cohen discloses a processor for receiving and playing real-time audio signals over a multi-node communication network which adjusts the size of a jitter buffer by changing the speed of at least some of the audio data in the buffer,

and it would have been obvious to modify Ohlsson with the teachings of Cohen.

The examiner has noted that Ohlsson does not explicitly show the use of a speed control module that adjusts the rate of voice packet consumption in response to the variation in jitter buffer size. In fact Ohlsson lacks any form of playback speed control as a mechanism for adjusting the size and alignment of the jitter buffer. For example, Figure 1 indicates no speed control means. The specification, in discussing the flow chart of Figure 4 at Column 7 lines 39 - 43 states "Packets are discarded when the size of the jitter buffer is decreased, so more caution is usually appropriate to avoid excessively discarding packets when there are rapid up/down changes in the network transmission delay." At column 9 lines 49 - 53 it is stated that "As indicated by step 516, the jitter buffer size is increased by denying the application newly arriving packets according to the number determined in step 514." Ohlsson appears to monitor in a completely different manner. He counts the number of packets arriving in a fixed period of time while applicant measures the variation in transit delay between arriving packets. While each is used to adjust the jitter buffer, these are totally different means of monitoring the delivery of packets and result in a different means of adjusting the jitter buffer.

The Ohlsson invention is specifically designed to use frame discarding and frame starvation as the means to change the size of the jitter buffer. Because he designed his control logic based on this assumption, he does not address rapid changes in network delay. In contrast, applicant's invention is purposely designed to specifically address such short (and long) term delay variation. By using a speed control mechanism independent from the jitter buffer but controlled by the jitter buffer manager, the system can immediately and aggressively react to changes in network delay if the behavior of the network merits such action. In practice, this is a patentably distinct difference since it allows pre-emptive changes

in the size and delay of the jitter buffer at the very earliest stage of a change in network delay. The sooner a sudden increase or decrease in network flow is attacked the better chance the system has of avoiding running the jitter buffer completely empty or building up an annoying larger delay in the jitter buffer due to a large backlog of audio data in that buffer.

An additional important differences over Ohlsson is in the means of measuring delay and jitter. Ohlsson examines a fixed "sampling interval" of time (claim 2, claim 12, and in more detail Column 7 lines 13 to 27) by measuring all expected arrival times relative to the first packet in the fixed sampling interval and then determines jitter based on variance from those expected delays. This method is prone to large periodic errors if the first packet on the particular sampling interval is unusually early or late. As a result, all of the packets following in that sampling interval will be judged relatively much more early or late and with much higher jitter than is actually true. This also means that reactions to changes in network delay cannot begin to happen until one or more sampling intervals have transpired. Applicant uses a different design where a continuously updated moving average is used as the reference to determine the delay and jitter of each packet (and indeed each frame within that packet). This eliminates a number of issues with arise as a result of using a fixed sampling interval and the first packet in that interval as a reference, and also allows much faster detection and thus reaction to changes in network delay.

Referring to the Ohlsson flow chart in Figure 4, he counts late packets after they have already arrived late (and were thus heard as drop-outs in the audio flow) and only after detecting one or more of them is the change indicator incremented and the size of the jitter buffer eventually increased. In contrast, applicant's invention measures each packet arrival and each consumption of audio data and adjusts the size of the jitter buffer as needed prior to packets arriving too late for use so that the end user does not hear any discontinuity.

Cohen fails to show or suggest the above discussed missing function. The Cohen design, as shown in Figures 1 - 5 does not use speed control as the means to adjust the size of the jitter buffer. The Cohen technique for shrinking the jitter buffer, as shown in Figure 5, specifically requires first attempting to discard leading silence, then secondarily discarding silence between words, and finally discarding audio packets if the first two attempts have not brought the jitter buffer down to the desired, smaller size. Cohen shows no adjustment to the delivery of packets to enlarge the jitter buffer. He just provides a box labeled "enlarge

buffer". For comparison, the embodiment of applicant's invention as set forth in Figures 3, 4a and 4b uses speed control as the means to accomplish all temporal adjustments which are required in order to change jitter buffer size. Cohen mentions speed control in the discussion of his Figure 5 as a third and last alternative for increasing the size of the jitter buffer (Col. 6, line 57 - Col 7, line 7). He indicates that null audio should first be sent out; if that's not possible then silence should be inserted between words. If those procedures fail "...the playing time of one or more packets in the buffer is enlarged (i.e. change individual packet sizes) such that the packets occupy more room in the buffer." These describes a mechanism closely matching the right side of Fig. 5 where he explicitly first attempts modifying long silent sections, then if that fails to make enough change he alters silence between words, and only then does he alter the voice data itself. This mechanism operates on the packets in the jitter buffer itself, making them "occupy more room in the buffer". In contrast applicant uses a speed control module which is the sole means to perform temporal alignment. The speed control mechanism is operated after the jitter buffer is enlarged to hold more packets or reduced to hold less packets and independently from the speed control under the direction of the jitter buffer manager as shown in Applicant's Fig. 3, 7a and 7b, and discussed at page 8, lines 19 - 32.

Cohen's procedure to determine the size of the jitter buffer, and thus make changes to it, is entirely driven by what appears to be a simple count of the number of packets presently sitting in the jitter buffer. His calculation of "jitter" in step 100 of Fig. 4 and as discussed at Col. 6, lines 28 - 37 is simply a periodic subtraction of the "current size of the jitter buffer 40 and the size of the buffer in a previous invocation of the update procedure". Cohen then changes, adds or reduces space between packets before changing the size of the packets using a voice speed-up or slow down method (Col 7, lines 1-12). This does not show or suggest applicant's technique where each and every arriving packet from the network causes a constantly updated set of delay and variance measures to be determined. These variance measures then drive the jitter buffer manager to control the size of the jitter buffer and the operation of the speed control module which is downstream of it. Because of the differences between Ohlsson and Cohen, and the specific teachings of each as to their manner of operation, one skilled in the art would not combine Ohlsson and Cohen. However, even if Cohen were combined with Ohlsson, applicant's invention as set forth in claims 1 and 10

would not result. The result would not be to control the delivery of the packets, but instead would be to vary the spacing between packets or to change the size of the packets to fill the space available in the jitter buffer, which applicant does not do. Instead, as set forth in claims 1, applicant controls the rate at which each packet is delivered, i.e. "modifying a rate of consumption of packets serially output from said jitter buffer" and varying the size of the jitter buffer to hold more or fewer packets to provide a more uniform delivery of packets and resultant audio output. Likewise, as set forth in claim 10, applicants calculate the average packet delay (the space between packets) and adjust the buffer size (not the packet size) to accommodate variations in arrival time of packets. Accordingly claims 1 and 10 are not shown or suggested by the combination of Ohlsson and Cohen, are patentably distinct from the cited references and the claims dependent thereon, namely claims 2- 8 and 11-16 must likewise be found to be patentable. In regard to the limitations set forth in Claims 2, 3 and 16 the arguments set forth above are reasserted. Irrespective, of any similarities which may exist between certain features of applicants' invention as set forth in these dependent claims and the Ohlsson and/or Cohen disclosure, because claim 1 and 10 are patentably distinct, these dependent claims are likewise patentably distinct.

In regard to claims 2 and 13, Ohlsson (col. 8, lines 19 and 31-36) accumulates and stores time variances in a variance buffer 20 which is the size of the sampling interval. These variances are not used to adjust the jitter buffer until the variance buffer is full, and therefore corrections cannot be made during the sampling intervals or upon the arrival or consumption of individual packets. The Ohlsson sampling interval cannot be set to the size of a single packet since his variance measure is based on the difference in arrival time between the first packet in the sampling interval and the following ones. Applicant measures variance for each and every packet and adjusts accordingly, resulting in a much higher quality of delivered audio.

In regard to claim 3 and 16 Ohlsson (col. 7, lines13-16 and 28-34) determines if the buffer has received a number of packets in a specific time interval greater than should have been received. If so, it then determines the number of late arriving packets, and determines if the loss of these late packets is acceptable. If not, the change indicator is increased or decreased which can then lead to subsequent adjustment of the jitter buffer. The Ohlsson design waits for the packet loss to happen, and then adjusts to a new size which would have

done a better job on the packets that were already lost. In contrast, as set forth in applicants claim 3, as explained at page 13, lines 16-31) an average packet variance is calculated for each and every arriving packet and is used to immediately infer the likelihood that the observed level of variance will soon result in lost packets. There is no sampling interval to transpire while waiting for packets to be late, and the arrival of late packets is not used to determine changes in jitter buffer size. The applicant can make changes to the size of the jitter buffer as packets arrive near the edge of the jitter buffer (which will produce high APV values) but which are not themselves late. This is a totally different function resulting in superior quality of sound delivered.

In regard to claims 4-7 and 12 , Cohen (Col 2, lines 16-22 and 22-28) describes a system where the contents of the jitter buffer itself are operated on to enlarge or reduce its size. Entire packets are selective duplicated, destroyed, or silent packets are added. In contrast applicant, as set forth in claims 4 –7 specifies an independent speed control module which operates subsequent to the jitter buffer under the control of the jitter buffer manager as discussed at page 20 lines 13-16 "In most cases the speed control technique is applicable to the decoded audio, not the encoded packets, and thus should be applied after decoding." This is different because a post-decode speed control routine can perform much shorter and higher quality adjustments to the audio stream instead of simply decimating or duplicating encoded packets in the buffer itself and results in both finer control over the rate of audio consumption as well as better sound quality when the audio flow is operating at a non-standard rate.

In regard to claims 8 and 11, Cohen (Col 2, lines 34 -39)specifies "changing the time used to play each received audio data packet", again pointing to performing adjustment on individual packets in the jitter buffer.. In contrast applicant, as set forth in claims 8 and 11 calls for changing the "rate of consumption" of data out of the jitter buffer by means of a speed control module that is subsequent to the linear output of the jitter buffer and which does not need to operated on the individual encoded audio data packets contained within the jitter buffer.. This is different because finer grained adjustments in jitter buffer consumption rate can be attained and superior speed control techniques can be used which operate on an arbitrary amount of linear sound data instead of having to function solely on the unit of an encoded audio data packet and results in better control of the jitter buffer and superior sound quality.

In regard to claims 14 and 15, Ohlsson (Col 9, lines 14-45 and Fig 7B) describes a system where a "sampling interval" is used to examine packet variances against the first packet in that sampling interval, and based on the range of variances the appropriate reduction in jitter buffer size can be decided in order to keep the jitter buffer from introducing more delay than conditions merit.. In contrast applicant, as set forth in claims 14 and 15 uses no sampling interval of any kind and instead employs a constantly updated average packet variance measure which is calculated upon every single packet arrival and which does not reference from the arrival time of the first packet in a sampling interval.. This is different because Ohlsson's method requires long sampling intervals to transpire before making any decision, and the variance measurements within those intervals are subject to large bias if the first packet in the sampling interval happens to be unusually early or late causing all subsequent packet variances in the sampling interval to be incorrectly calculated to be too large or too small. Applicants average packet variance method is updated immediately upon each arrived packet and is resistant to any single packet arriving early or late relative to its neighbors and results in more accurate control of the size of the jitter buffer under various network conditions and thus superior audio quality and delay characteristics.

Claims 9 was rejected under 35 USC §103(a) as being obvious based on Ohlsson (US Patent 6,452,950) in light of Cohen (US Patent 6,389,032) and further in light of Shlomot (US 6,377,931 for the reasons set forth in regard to claims 1- 8 and 10-16 in that Ohlsson and Cohen do not show an audio decoder arranged to receive packets from the speed control module but Shlomot discloses a speech communications system where a speed controller is used to dynamically adjust the size of a jitter buffer and to instruct a decoder to decode audio packets from the jitter buffer.

Shlomot is similar to Cohen in that it uses a similar control mechanism. It simply counts the number of packets in the jitter buffer and has primitive "too full" and "too empty" triggers to enact any change in jitter buffer size (Col. 5, lines 25 – 34, Col. 6, lines 19-36). Applicant's invention uses a very different and superior control mechanism that can take action based on the arrival times of individual packets. The Shlomot control mechanism would be unable to distinguish between packets which were lost and never arrive vs. packets which are delayed and arrive late (both would result in a momentary drop in the count of packets in the jitter buffer, but only the presence of late packets is reason to enlarge the jitter

buffer – packets that are lost by the network and which never arrive will cause the Shlomot jitter buffer to grow and grow endlessly seeking to get large enough to capture the missing packets which will never arrive.

Shlomot is also similar to Cohen in that the speed control mechanism is described as operating on discrete speech segments stored in the jitter buffer rather than being available to change speed at any time and over any interval independent of the contents of the jitter buffer. Shlomot states (Col 6, lines 43 – 47) "According to a disclosed embodiment, the overflow indicator from the pointer 340 is used to signal a compression function for merging a number of stored speech packets into a smaller number of speech segments by the speech decoder 240.

In regard to a combination Ohlsson, Cohen and Shlomot, as discussed above applicant's invention is different from Ohlsson, which lacks any form of speed control, and Cohen and Shlomot, both of which lack anything resembling a sophisticated packet-arrival-timed control mechanism. Not only is it not obvious to combine the three in order to come up with applicant's claimed invention, it is not possible to do so. Applicant's control mechanism for making decisions about the size of the jitter buffer is different than all three. None of the cited references focused on the main point of applicant's invention which is to perform jitter buffer size changes aggressively and immediately upon the first sign of changes in the network so that more time is available to mask those changes through the use of speed control that is the main and only means of temporal adjustment and which operates completely independently of the speech packets contained in the jitter buffer. The Ohlsson design can't take aggressive immediate action on the jitter buffer size because he has to wait for a convenient chunk of silence to come along before he can change the size of his jitter buffer. With typical jitter buffer sizes in the 40 mSec to 200 mSec region the jitter buffer will have long since run dry before the person speaking takes a breath to give Ohlsson the chunk of silence he needs in order to make a size change. The Cohen and Shlomot control mechanisms are too slow to detect the early onset of changes in network delay and thus they are unable to make aggressive early changes in the size of the jitter buffer – they won't find out about the problem until they are nearly empty and there's nothing in their jitter buffer to slow down or speed up.

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It is noted that the examiner has found that applicant's control logic which maintains the jitter buffers "centered-ness" (claim17) is not shown by the prior art and would be allowable if amended to be independent. Claim 17 has been so amended.

Claims 1-17 remain in the application, claim 17 now dependent and incorporating the features of claims 10 and 11, and claim 18 has been added by this amendment. It is respectively submitted that these claims are patentable, fully supported by the Specification and not shown by the prior art. It is requested that the claims be found to be patentable and a Notice of Allowance be issued.

Respectfully submitted,

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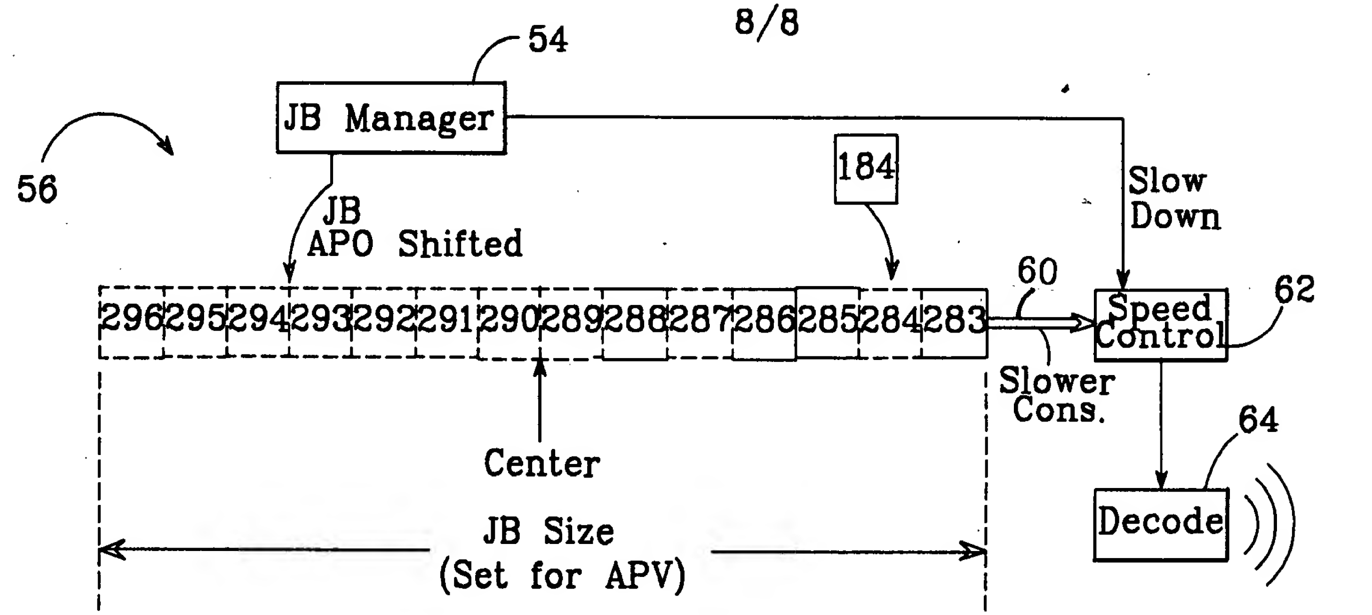

FIG. 7a

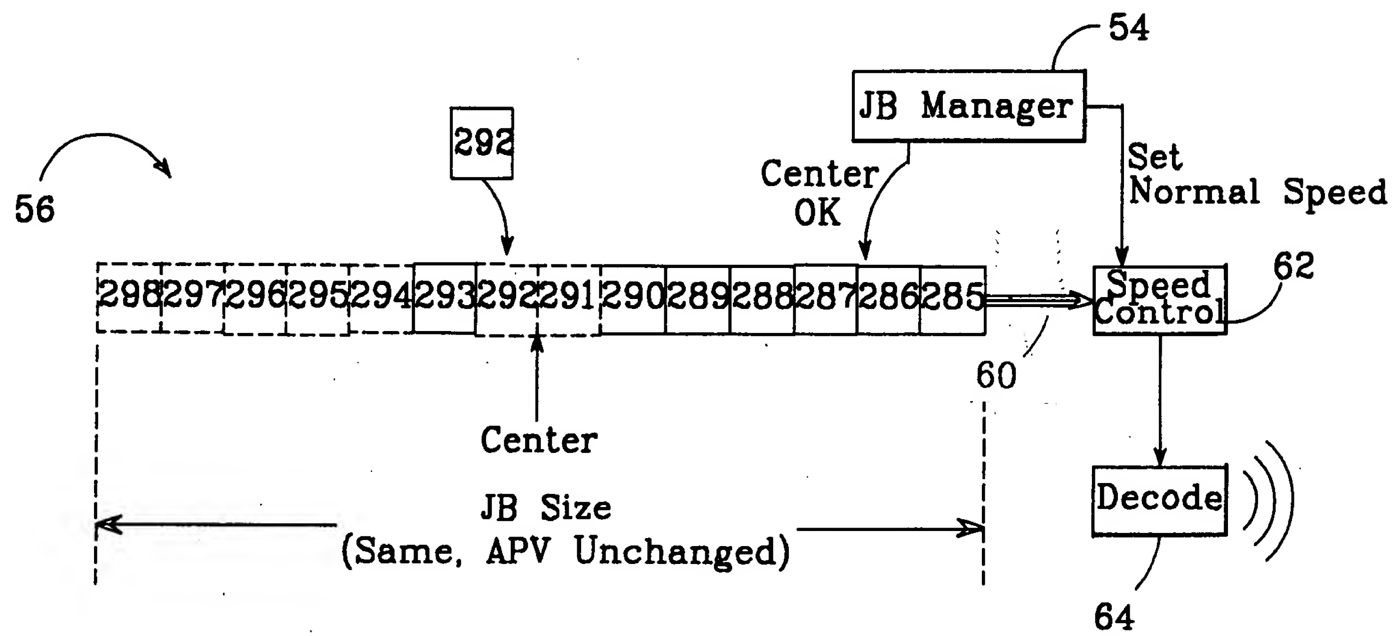

FIG. 7b

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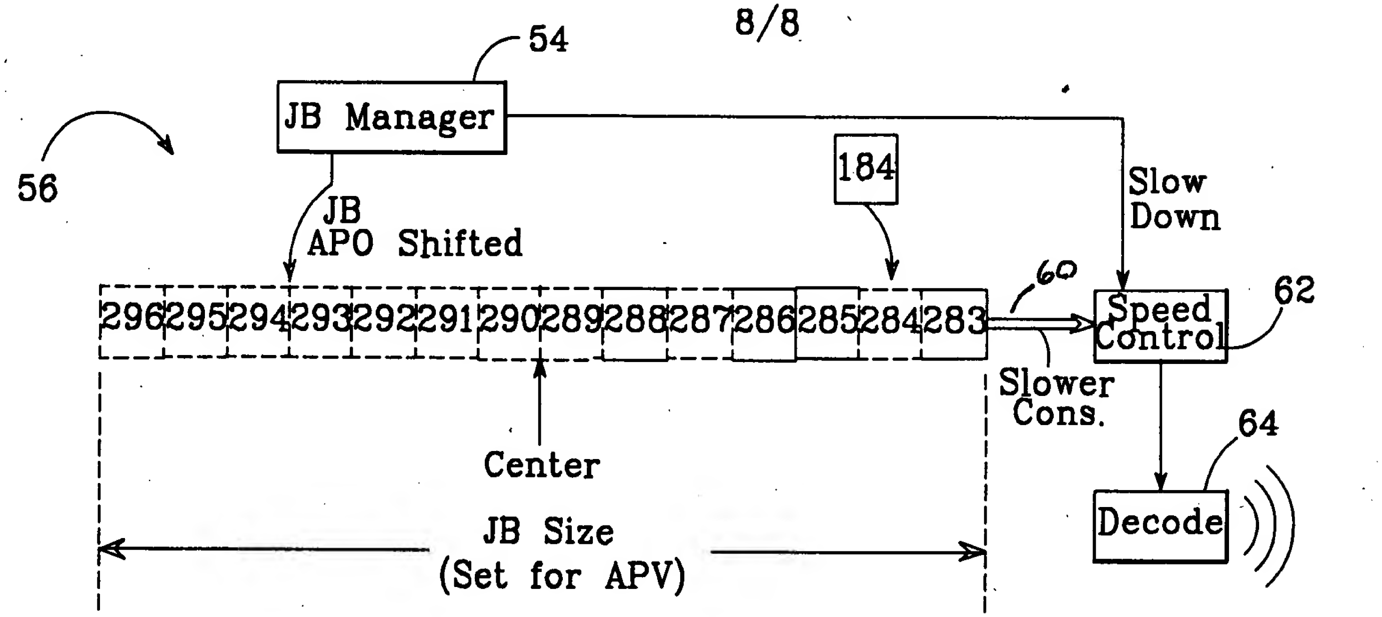

FIG.7a

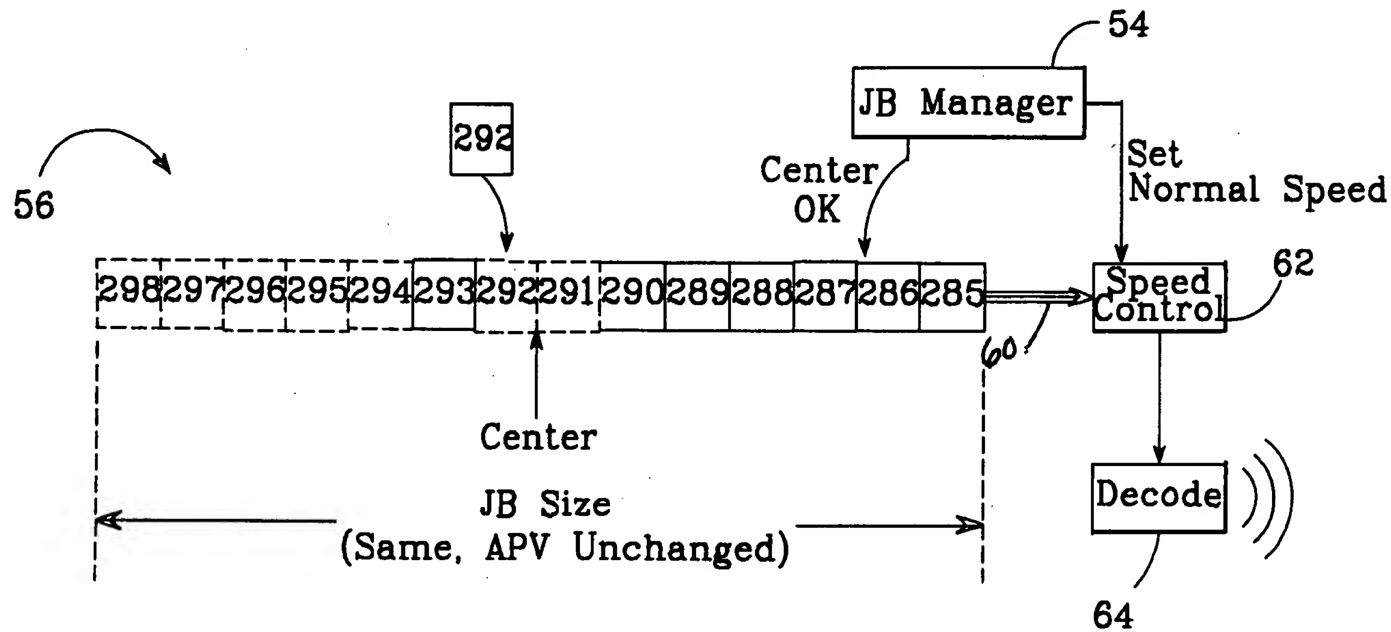

FIG.7b